Carrier HEATING & COOLING

# 50YA Water Source Comfort System

# Installation and Start-Up Instructions

**NOTE:** Read the entire instruction manual before starting the installation.

## SAFETY CONSIDERATIONS

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions attached to the unit. Consult local building codes and the National Electrical Code (NEC) for special installation requirements.

Recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the unit or in instructions and manuals, be alert to the potential for personal injury.

Understand the signal word DANGER, WARNING, or CAUTION. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards that **could** result in personal injury or death. CAUTION is used to identify unsafe practices which **would** result in minor personal injury or product and property damage.

**⚠ WARNING**

Electrical shock can cause personal injury or death. Before installing or servicing system, always turn off main power to system. There may be more than 1 disconnect switch. Turn off accessory heater power if applicable.

## INSTALLATION

### Step 1—Check Jobsite

HORIZONTAL UNITS

Because horizontal units are designed for installation above a false ceiling or ceiling plenum, access becomes an important consideration. Be sure that the site chosen for unit installation provides enough clearance to allow easy maintenance or servicing of the unit without removal from the ceiling. Refer to Fig. 1 for a typical horizontal unit.

INSTALLATION GUIDELINES

1. Provide a hinged access door (inconcealed-spline or plaster ceilings), or removable tiles (in T-bar or lay-in ceilings).

   The access opening must be large enough to allow the service technician to service the unit (including compressor removal and replacement), and to permit removal of the unit. See Fig. 2 for base unit dimensions.

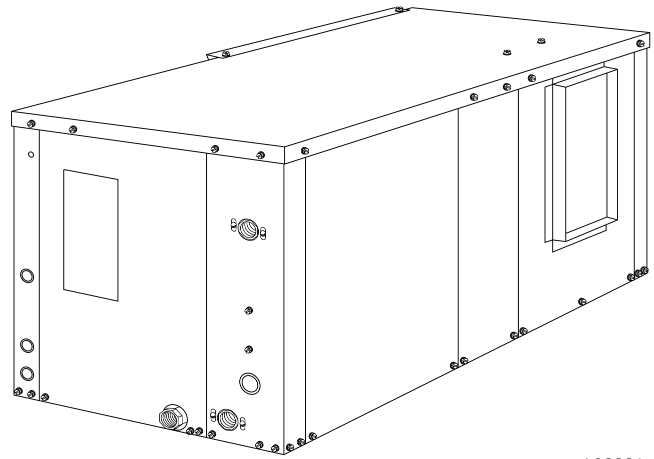

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**Fig. 1—Model 50YAH**

2. Provide easy access to hanger brackets, water valves, and fittings, and allow screwdriver clearance to access panels, the discharge collar, and all electrical connections.
3. If a return duct is used, be sure to provide a duct slot for filter replacement.
4. To allow removal of the unit, do not run obstructions (for example, piping, electrical cable, etc.) under the unit.
5. Minimize obstructions in the conditioned space beneath the unit whenever possible. A manual, portable jack can then be used to lift and support the weight of the unit during installation or servicing.

VERTICAL UNITS

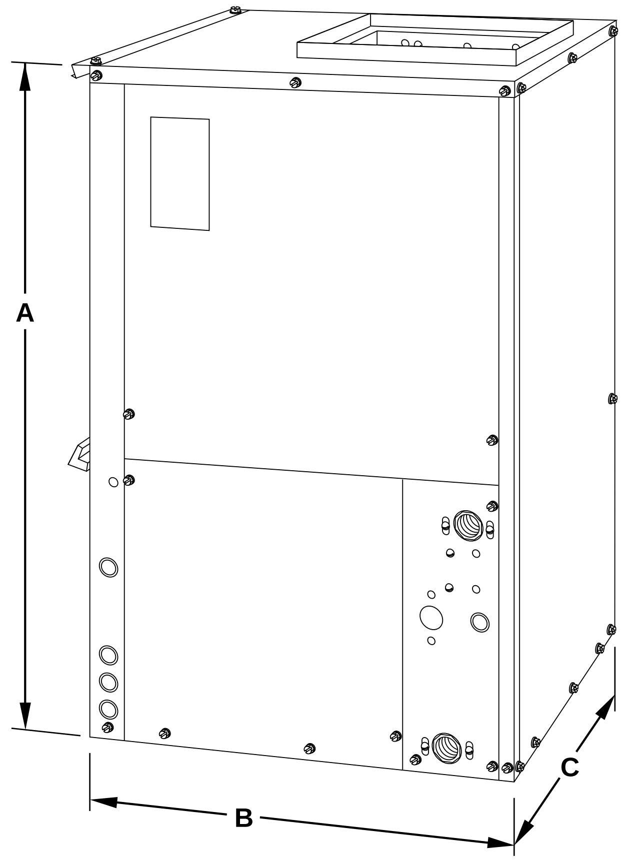
While vertical units are typically installed in a floor level closet or basement. The unit access guidelines for vertical units are very similar to those described for horizontal units. Refer to Fig. 2 for base unit dimensions and Fig. 3 for condensate trap installation.

UNIT LOCATION

1. Provide adequate clearance for filter replacement and drain pan cleaning. Do not allow piping, conduit, etc. to block filter access.
2. Provide sufficient access to allow maintenance and servicing of the fan and fan motor, compressor, and coils.
3. Provide an unobstructed path to enable removal of the unit from the closet or utility room.
4. Provide ready access to water valves and fittings, and allow screwdriver access to unit side panels, discharge collar, and all electrical connections.

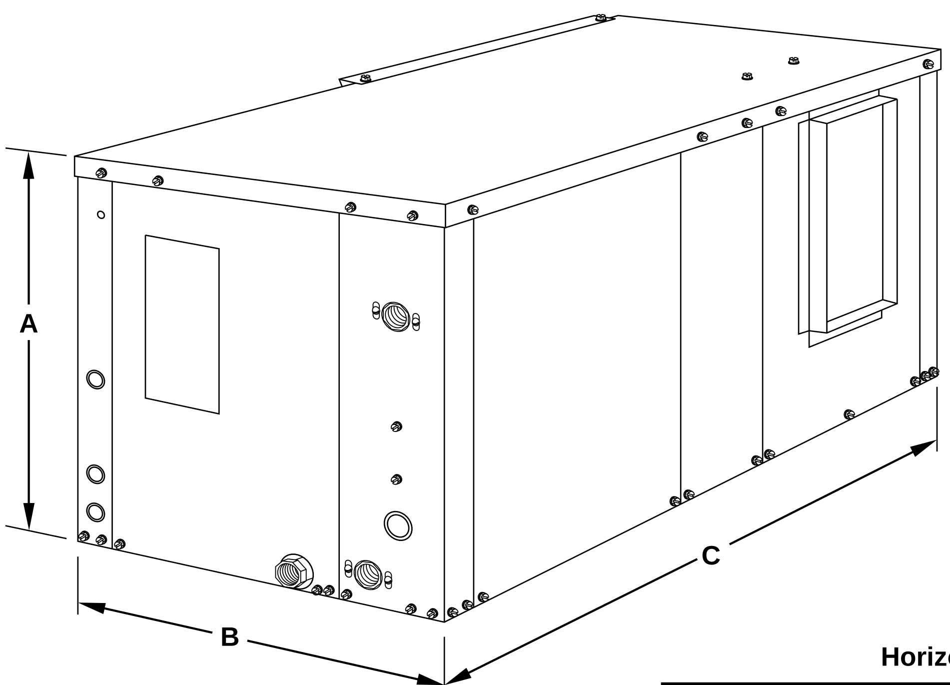
### Step 2—Check Unit

Be sure to inspect the carton or crating housing each unit as it is received at the job site. Verify that all items have been received and that there is no visible damage; note any shortages or damage on all copies of the freight bill. In the event of damage or shortage, remember that the purchaser is responsible for filing the necessary claims with the shipping company.




### Vertical Models

| UNIT SIZE | A (IN.) | B (IN.) | C (IN.) |
|---|---|---|---|
| **009,012** | 24-1/8 | 19-1/8 | 19-1/8 |
| **015,019** | 37-1/2 | 21-1/8 | 21/1/8 |
| **024,030** | 37-1/2 | 21-1/8 | 18-1/8 |
| **036** | 42 | 25-5/16 | 25-5/16 |
| **042-060** | 43-3/16 | 28-1/8 | 28-1/8 |




### Horizontal Models

| UNIT SIZE | A (IN.) | B (IN.) | C (IN.) |
|---|---|---|---|
| **009,012** | 11-1/8 | 20 | 34 |
| **015,019** | 17 | 20 | 43 |
| **024,030** | 19 | 20 | 43 |
| **036** | 21 | 20 | 47 |
| **042-060** | 21 | 36-1/4 | 36-1/4 |

**Fig. 2—Base Unit Dimensions**

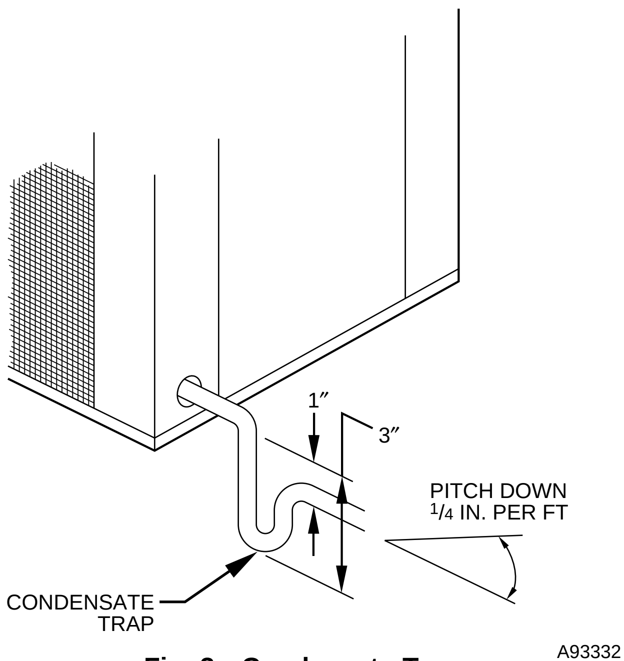



**Fig. 3—Condensate Trap**

Loosen the compressor mounting bolts to remove the 3 shipping blocks if equipped before installation.

A periodic maintenance checklist is provided in the maintenance section to outline recommended maintenance schedules. Do not substitute these checklist for the detailed information found in the appropriate sections of this manual.

STORAGE

If the equipment is not needed for immediate installation upon its arrival at the job site, it should be left in its shipping carton and stored in a clean, dry area of the building, or in a warehouse. Units must be stored in an upright position at all times. If carton stacking is necessary, stack units as follows: horizontal units, maximum 4 high; vertical units up to and including model 060, 3 high. Do not remove any equipment from its shipping package until it is needed for installation.

UNIT PROTECTION

Once the units are properly positioned on the job site, they must be covered with either a shipping carton, vinyl film, or an equivalent protective covering; open end of pipes stored on the job site must be capped. This precaution is especially important in areas where painting, plastering, or spraying of fireproof material, etc. is not yet complete. Foreign material that accumulates within the units can prevent proper start-up and require costly clean-up operations.

Before installing any of the system components, be sure to examine each pipe, fitting, and valve, and remove any dirt found on these components.

Do not use these units as a source of heat during construction of the building since the filters will quickly fill with construction dirt and debris. It is strongly recommended that an alternative means of providing temporary heat be used.

INSPECT UNIT

To prepare a unit for installation, complete the instructions listed below:

1. Compare the electrical data on the unit nameplate with ordering and shipping information to verify that the correct unit has been shipped.
2. Do not remove the cardboard carton until the unit is ready for installation.
3. Verify that the refrigerant tubing is free of kinks or dents, and that it does not touch other unit components.
4. Inspect all electrical connections; connections should be clean and tight at the terminals. The compressors are internally spring-mounted. Those equipped with external spring vibration isolator must have bolts loosened and shipping clamps removed.

### Step 3—Mounting the Unit

MOUNT UNIT—HORIZONTAL

While horizontal units may be installed on a suitable surface strong enough to hold their weight, they are typically suspended above a ceiling or within a soffitt using field-supplied, threaded rods to support the weight. See Fig. 4 for elevation line information.

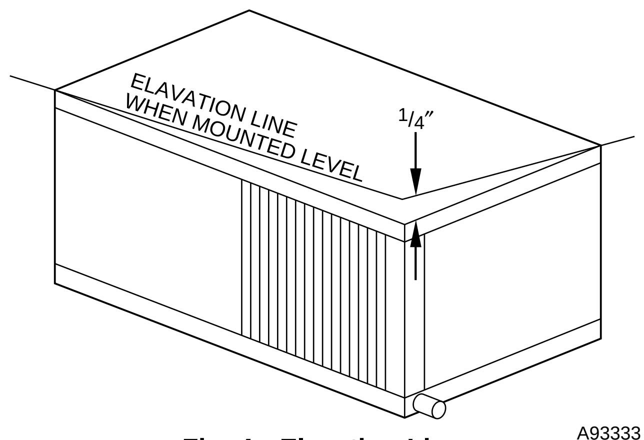



**Fig. 4—Elevation Line**

A mounting kit (which includes 4 mounting brackets and vibration isolators) is shipped inside the blower compartment of the unit. Attach the brackets and isolators to the bottom corners of the unit. Then use 4 field-supplied threaded rods to suspend the unit. (See Fig. 5.)

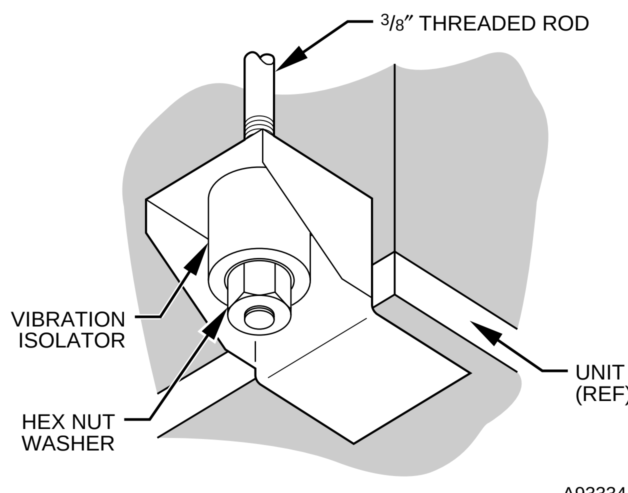



**Fig. 5—Hanger Kit**

Remember that the unit must not be mounted flush with the floor slab above, but should hang clear and be supported only by the mounting bracket assemblies. A minimum of 30 in. is recommended for fan section, compressor section, and electrical access. Allow 1 ft clearance for non-ducted return-air flow.

Unit installation within the plenum should provide adequate clearance for filter removal. On those applications with a return air plenum, a slot for filter removal (i.e., toward the front) must be provided.

Normally it is required that the heat pump be installed in a protected space inside the conditioned area. If the unit is installed in an unconditioned space, it is imperative that it be isolated and protected so that its physical temperature is maintained at 60°F or above. All water pipes that are subject to freezing must be insulated. All connections to the heat pump by ducting, plumbing, etc., must follow ASHRAE standards. All local codes must be followed during installation.

Locating the unit in crawl spaces or attics in areas subject to extreme cold should be avoided.

**NOTE:** An auxiliary drain pan at least 4 in. larger than the bottom of the heat pump must be used.

MOUNT UNIT—VERTICAL

Vertical heat pump units are usually installed on the floor. To properly isolate the unit, be sure to place a piece of rubber or neoprene under the unit; the pad should extend beyond the edges of the unit, and should be 3/8-to l/2-in. thick. (See Fig. 6.)

SOUND ATTENUATION—HORIZONTAL UNITS

Correct placement of the horizontal unit can play an important part in minimizing sound problems. Since ductwork is normally applied to these units, the unit can be placed so that the principal sound emission is outside the occupied space in sound-critical applications. A fire damper may be required by a local code if a fire wall is penetrated.

SOUND ATTENUATION—VERTICAL UNITS

Because vertical units are usually in basements or closets , the location of the unit often serves as the primary means of sound attenuation. (See Fig. 6.) Additional measures for reducing sound transmission include the following:

1. Use a sound baffle, as shown in Fig. 6, to attenuate line-of-sight sound radiated through the return-air grilles.
2. Mount the unit on a rubber or cork isolation pad to minimize vibration transmission to the building structure (The entire base of the unit—not just the corners—should rest on the pad to ensure adequate isolation.)

### Step 4—Make Duct Connections

A flange is provided at the blower opening to facilitate duct connections. A flexible connection must be made between the heat pump and to any supply and return metal ducting. All ducting should be insulated to avoid heat loss in both heating and cooling cycles and keep from forming condensate during cooling operation.

Existing ductwork should be checked to ensure that proper airflow is possible. The factory specifications on the fan capacity must be checked to ensure that the correct amount of air will pass through the heat pump. Check all existing ducts for leaks and repair before operating. The unit is factory wired for medium speed (blue wire). High speed (black wire) and low speed (red wire) taps are provided.

### Step 5—Make All Piping Connections

Besides complying with any applicable codes, system piping should also include the following features:

1. A drain valve at the base of each supply and return riser to enable system flushing at start-up and during routine servicing.
2. Shut-off/balancing valves and unions at each unit to permit unit removal for servicing.
3. Strainers at the inlet of each system circulating pump. (Shut-off balancing valves, flow indicators, and drain tees in the supply runout and return at each floor facilitate loop balancing and servicing.)

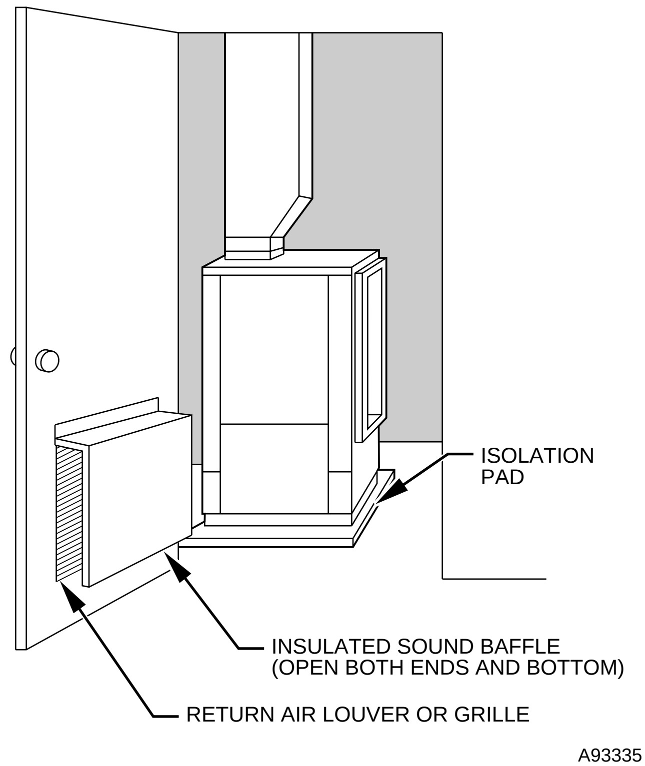



**Fig. 6—Vertical Sound Attenuation**

Insulation is required on all exposed loop water piping. If the loop temperature falls below 60°F, the piping will sweat and suffer heat loss.

**⚠ CAUTION**

Failure to insulate loop piping may result in damage from condensate dripping on surrounding equipment and structures.

Though the horizontal run of the condensate hose is usually too short to pose any drainage problems, it is important to remember that horizontal runs of condensate line are typically pitched at least 1 in. for every 10 ft of run in the direction of flow. Low points and unpitched piping cannot be allowed, since dirt will collect in these areas and cause stoppage and overflow.

To ensure proper condensate flow from units, a condensate trap must be installed at each unit with the top of the trap positioned below the unit condensate drain connection. Trap must be at least 3 in. deep. (See Fig. 3.) Pitch condensate line to open drain or sump. When condensate line is subject to sweating, proper material or insulation may be required. Condensate trap must be primed prior to unit operation.

### Step 6—Make Electrical Connections

**⚠ WARNING**

To avoid possible injury or death due to electrical shock, open supply power disconnect switch and secure it in that position.

**⚠ CAUTION**

Use only copper conductors for field-installed electrical wiring. Unit terminals are not designed to accept other types of conductors.

Install a branch circuit disconnect switch per NEC of adequate size to handle unit starting current Locate disconnect within sight and readily accessible from the unit, per Section 440-14 of the NEC.

All field-installed wiring—including the electrical ground—must comply with the NEC, as well as applicable local codes. In addition, all field wiring must conform to the Class II temperature limitations described in the NEC. Refer to Fig. 7 for a schematic of the field connections which must be made by the installing or electrical contractor. Refer to Fig. 8. for thermostat wiring.

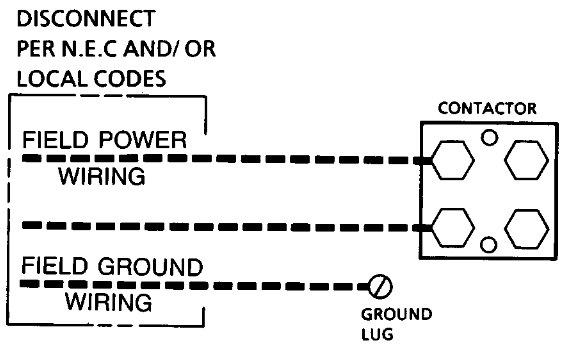



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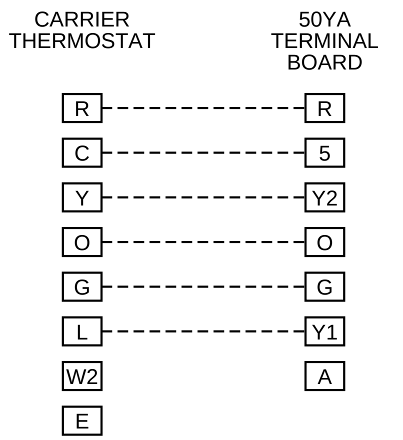
**Fig. 7—Line Power Connection**




**NOTE:** Supplemental heat (W2) and emergency heat (E) will control an independent heating source and must be interlocked through fan circuit (G).

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**Fig. 8—Thermostat Wiring**

To ensure proper electrical hookup, be sure to consult the unit wiring diagram pasted on the inside surface of the electrical access panel. The 24-v transformer connection must be modified if the unit nameplate voltage is 208-230v, and the actual supply power is 208v.

**NOTE:** To minimize vibration and sound transmission to the structure, all final unit electrical connections should be made with a length of flexible, rather than rigid, conduit.

### Step 7—Water Quality Limitations

The water supply need not be suitable for human consumption, but should be evaluated for degree of impurity. Impurity testing is available from independent testing labs, health departments, or state agencies. Potential problem areas, and the appropriate heat exchanger coil are described in Table 1.

AVOIDING POTENTIAL PROBLEMS

All water contains some degree of impurities which may affect the performance of a heat pump system. The use of a cupronickel coil can help avoid potential problems.

Most potential problems can be avoided by ensuring the water system is sealed and free of air leaks, and maintaining the proper water flow rate.

Water flow rates should:

1. Be high enough that the temperature rise through the heat exchanger does not exceed 10°F when operating in the cooling mode.
2. Not exceed 4 gpm per nominal ton. Flow rates that have velocities of 10 ft/s or more may cause pipe erosion and heat exchanger failure.

Water source heat pumps typically require a water flow rate of 2 to 3 gpm per nominal ton. Flow rates may need to be somewhat higher in northern climates during winter. During periods of extreme weather, the heat pump(s) may run continuously for extended periods of time. Therefore, the water supply must be able to deliver the required water flow continuously for 24 to 48 hours or more. Thorough "draw down" testing will indicate if the well has the capacity to handle long term demand. It is the responsibility of the well driller to know and adhere to all appropriate codes and regulations.

Pump size and location are other considerations. Carefully evaluate lift, power requirement, run time, etc. to ensure the energy saved by the water source heat pump is not consumed by the well pump.

EARTH COUPLED-CLOSED LOOP HEAT PUMP

The closed ground loop is coupled to the earth by a system of pipes buried in the ground or submerged in coils in lakes, rivers, and streams. The ground-coupling method takes advantage of the earth's temperature to cool or heat the circulating water or other heat transfer fluid.

The earth coil or closed-loop system may be installed horizontally or vertically. The length of the earth coil is determined by the size of the heat pump, climatic conditions, soil temperatures, soil type, and other sizing variables. The closed-loop systems are pressurized and circulate the same water or fluid. Since the earth coil is closed and pressurized, the required pumping power for circulation is considerably less than the pumping power required for an open system.

An antifreeze is often required in the ground-loop to prevent freezing. Local codes must be consulted. See Table 2 for potential antifreezes.

## SYSTEM CHECKOUT

After completing the installation (including system cleaning and flushing) of the water source heat pump, a series of system checks and recordings os system parameters must be made.

**⚠ WARNING**

Before servicing unit, open unit disconnect switch to prevent injury or death due to electrical shock or contact with moving parts.

1. Check Voltage: Ensure that voltage is within the utilization range specifications of the unit compressor and fan motor.
2. Check System Water Temperature: Ensure that it is within an acceptable range to facilitate start-up. (See Table 3.) When conducting this check, be sure to verify the proper heating and cooling setpoints as well.
3. Check System Water pH: Verify that system water exhibits an approximately neutral balance (for example, a pH of 7.5 or 8.5); this will contribute to the longevity of the hoses and heat exchangers.
4. Check System Flushing: Proper system cleaning and flushing is the most important aspect of the start-up procedure for water source heat pump installations. Make sure that the system has been flushed properly.

**Table 1—Potential Problem Areas**

| POTENTIAL PROBLEMS | USE COPPER COIL | USE CUPRONICKEL COIL |
|---|---|---|
| **SCALING**<br>**Calcium and Magnesium Salts (hardness)**<br>**Iron Oxide** | Less than 350 ppm (25 grain/gallons)<br>Low | More than 350 ppm (up to sea water)<br>High |
| **CORROSION***<br>**pH**<br>**Hydrogen Sulfide**<br>**Carbon Dioxide**<br>**Dissolved Oxygen**<br>**Chloride**<br>**Total Dissolved Solids** | 7-9<br>Less than 10 ppm<br>Less than 50 ppm<br>Only with pressurized water tank<br>Less than 300 ppm<br>Less than 1000 ppm | 5 to 7 and 9 to 10<br>10 to 50 ppm<br>50 to 75 ppm<br>All systems<br>300 to 600 ppm<br>1000 to 1500 ppm |
| **BIOLOGICAL GROWTH**<br>**Iron Bacteria** | Low | High |
| **SUSPENDED SOLIDS** | Low | High |

*IMPORTANT: If the concentration of these corrosives exceeds the maximum tabulated in the Cupronickel column, then the potential for serious corrosion problems exists.

**Table 2—Antifreeze Solutions**

| TYPE | MINIMUM TEMPERATURE FOR FREEZE PROTECTION | | | |
|---|---|---|---|---|
| | 10°F | 15°F | 20°F | 25°F |
| **Methanol** | 25% | 21% | 16% | 10% |
| **Propylene Glycol** | 26% | 23% | 19% | 9% |
| **GS4** | 22% | 17% | 13% | 9% |

Notes: 1. All percentages are by volume (gal/gal), not weight.
2. Do not use calcium chloride as antifreeze.
3. Consult local codes before selection.

5. Check Balanced Water Flow Rate to Heat Pump: Make sure that the inlet and outlet water temperatures are recorded.

   This check will eliminate nuisance unit trip-outs resulting from water velocities that are either too low or too high; it can also prevent the occurrence of erosive water flow rates.
6. Check System Water Loop : Verify that all air is removed from the system. (Air in the system will impair unit operation and cause corrosion in the system piping).
7. Check Unit Filters: Check to ensure that unit filter is clean; this will contribute to the proper operation of the unit by ensuring adequate airflow across the coil.

**⚠ WARNING**

Before checking fans, open unit disconnect switch to prevent injury or death due to electrical shock or contact with moving parts.

8. Check Unit Fans: Manually rotate fans to make sure that they rotate freely, and that they are secured properly to the fan shaft. Do not oil fan motors on start-up; they were lubricated at the factory.

## START-UP

**⚠ WARNING**

High voltage is present in some areas of the electrical panels with the disconnect switch(es) closed. Be sure to exercise caution when working with energized equipment.

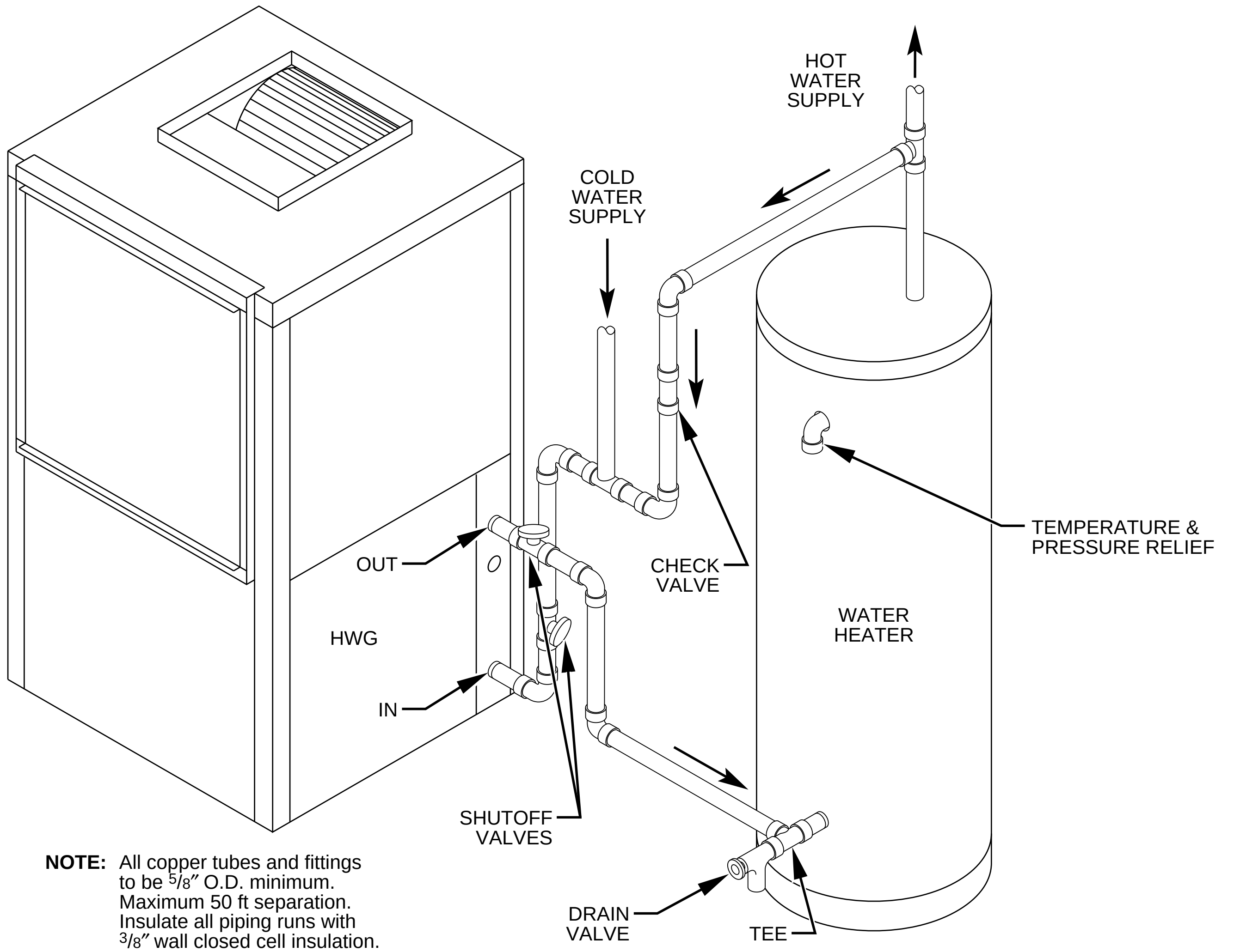
1. Adjust all valves to the full open position, and turn on the line power to all heat pump units.
2. Operate the unit first in the cooling cycle. Room temperature should be in the normal range (approximately 75°F to 85°F, dry bulb). Loop water temperature entering the heat pump should normally be at least 60°F, but not in excess of 95°F.

**NOTE:** Three factors determine the operating limits of a unit: (l) return air temperature, (2) water temperature, and (3) ambient temperature. Whenever any one of these factors is at a minimum or maximum level, the other 2 factors must be at normal levels to ensure proper unit operation.

   a. For heat pumps equipped with an optional, accessory manual changeover thermostat, adjust the thermostat temperature indicator to the lowest setting, and turn the selector switch to COOL. At this time, both the fan and compressor should run.
   b. For heat pumps equipped with an optional, accessory automatic changeover thermostat, set the thermostat temperature indicators to the far left position, and turn the selector switch to AUTO. At this time both the fan and the compressor should run.
   c. Check the elevation and flow of the condensate line.
3. Operate each heat pump in the heating cycle immediately after checking cooling cycle operation.

**NOTE:** Horizontal and vertical heat pumps are designed to start heating at a minimum return air temperature of 50°F with a normal water flow rate and ambient temperature.

   a. If the unit is equipped with an accessory thermostat, adjust the thermostat temperature indicator to the highest setting and set the selector switch to HEAT; both the fan and compressor should run.
   b. If the unit is equipped with an accessory thermostat, set the thermostat temperature indicator levers to the far right position with the selector switch still set on AUTO; both the fan and compressor should run.
4. If the unit fails to operate, conduct the following checks:




**NOTE:** All copper tubes and fittings to be 5/8″ O.D. minimum. Maximum 50 ft separation. Insulate all piping runs with 3/8″ wall closed cell insulation.

**Fig. 9—Hot Water Generator (Factory-Installed Pump)**

> **⚠ WARNING**
>
> Before servicing unit, open unit disconnect switch to prevent injury or death due to electrical shock or contact with moving parts.

a. Check the unit high and low voltage. It should be in accordance with the electrical specifications described on the unit nameplate.

b. Look for wiring errors; check for loose terminal screws where wire connections have been made on both the line and low-voltage terminal boards.

c. Check for dirty filters; a clogged filter will trip the safety circuit and stop unit operation.

d. Verify that the supply and return piping is properly connected to the inlet and outlet connections on the unit.

e. If the fan fails to operate, check to see that the fan wheel turns freely and that it is secured to the shaft. Also, determine whether the fan operates during both the heating and cooling modes.

SAFETY CONTROLS

The water source heat pump unit is equipped with safety controls which are designed to protect the unit in case of loss of air movement, water supply, or refrigeration charge. Safety controls should not be bypassed by a service technician if there is a failure.

The unit is equipped with a lock-out control which prevents the compressor from restarting when current is momentarily interrupted. The lock-out control functions when the low-pressure switch, high-pressure switch, or freezestat opens the control circuit.

When a trip occurs, the unit may be restarted by interrupting high voltage to the heat pump or by turning the thermostat to the OFF position, and then to the ON position. If the compressor overload has tripped, wait until the compressor has cooled to room temperature before attempting to restart the unit.

SAFETY DEVICES

The low pressure sensor is a high refrigerant temperature switch located on the compressor discharge tube.

The low pressure sensor will open when the compressor discharge temperature becomes too high. The low pressure sensor is usually activated by a low refrigerant charge. However, during the heating season, low return air temperatures and/or low water temperatures may cause this device to operate.

The high-pressure switch is mounted on the discharge line leaving the compressor and is set to open at 375 psi. The high-pressure switch is usually activated by a low water flow to the heat pump during the cooling cycle. The reset pressure is 290 psi. Manual restart of the heat pump is required once this switch opens.

The thermal overload is an integral part of the compressor. The overload will trip when the temperature and/or ampere ratings are exceeded, resulting in an overloaded compressor. The compressor can be restarted after it is allowed to cool to room temperature.

The 3 above devices, once activated, require that the heat pump be manually restarted at the thermostat or by opening and resetting the high voltage power supply. The safety devices are all 24v controls.

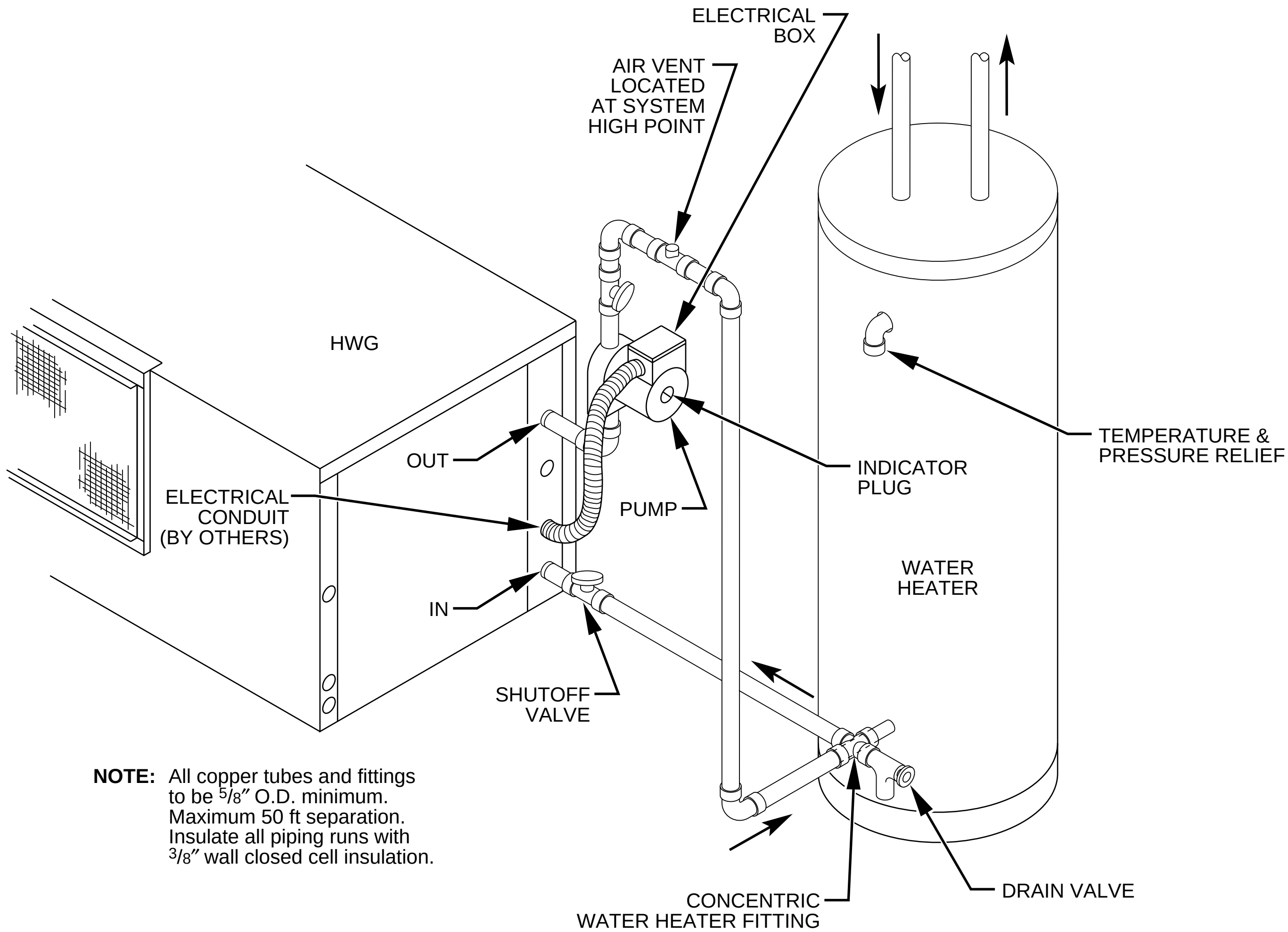



**Fig. 10—Hot Water Generator (Field Installed Pump)**

**Table 3—Operating Limits**

| OPERATING LIMIT | MINIMUM | NORMAL | MAXIMUM |
|---|---|---|---|
| **Power Supply Voltage 208-230-60-1** | 197 | 208-230 | 252 |
| **Entering Air Temperature:<br>Wet Bulb (Cooling)<br>Dry Bulb (Heating)** | 57<br>50 | 61-67<br>65-75 | 75<br>80 |
| **Entering Water Temperature:<br>Cooling<br>Heating** | 40<br>25 | 50-70<br>35-50 | 110<br>80 |
| **Surrounding Ambient (°F)(db, dry bulb; wb, wet bulb)** | 40 db | 75 db<br>63 wb | 70 wb |

Notes: 1. Determination of operating limits is dependant primarily upon 3 factors: (1) return air temperature, (2) water temperature, and (3) ambient temperature. Whenever any 1 of these factors is at a minimum or maximum level, the other 2 factors should be at normal levels to ensure proper unit operation.
2. Extreme variations in temperature and humidity, and corrosive water or air will adversely affect unit performance, reliability, and service life.

## WATER SOURCE COMFORT SYSTEM OPERATION

### COOLING MODE

When the water source comfort system is operated in the cooling mode, the reversing valve directs the flow of the hot gas being pumped by the compressor to the water-to-refrigerant heat exchanger. The heat is removed by the cooler water, and the hot gas condenses to become a liquid. The liquid refrigerant then flows through a metering device (capillary tube or expansion valve) to the air-to-refrigerant heat exchanger. The liquid then evaporates, becoming a gas, and at the same time absorbs heat from the air passing over the surface of the air coil. The refrigerant then flows as a low pressure gas through the other side of the reversing valve back to the suction side of the compressor to then begin the cooling cycle again.

### HEATING MODE

When the water source comfort system is operated in the heating mode, the reversing valve directs the flow of the refrigerant as a hot gas from the compressor to the air-to-refrigerant heat exchanger. The heat is removed by the cooler air passing over the surfaces of the coil, and the hot gas condenses and becomes a liquid. This liquid flows through a metering device (capillary tube or expansion valve) to the water-to-refrigerant heat exchanger. The warmer water in the water-to-refrigerant heat exchanger causes the liquid to evaporate, becoming a gas. At the same time, the refrigerant absorbs heat from the water. The refrigerant then flows as a low pressure gas through the other side of the reversing valve, back to the suction side of the compressor, to then begin the heating cycle again.

## Table 4—Cooling Operating Pressures (PSIG)

| UNIT SIZE | ENT. AIR TEMP. | ENTERING FLUID TEMPERATURE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 50 | | 70 | | 85 | | 110 | |
| | | Suct | Disch | Suct | Disch | Suct | Disch | Suct | Disch |
| **009** | 75 | 67-73 | 120-140 | 73-79 | 163-183 | 77-83 | 221-241 | 81-87 | 279-299 |
| | 80 | 70-76 | 130-150 | 76-82 | 173-193 | 80-86 | 231-251 | 84-90 | 289-309 |
| | 85 | 73-79 | 140-160 | 79-85 | 183-203 | 83-89 | 241-261 | 87-93 | 299-319 |
| **012** | 75 | 67-73 | 115-135 | 71-77 | 155-175 | 72-78 | 181-201 | 79-85 | 289-309 |
| | 80 | 70-76 | 125-145 | 74-80 | 165-185 | 75-81 | 191-211 | 82-88 | 299-319 |
| | 85 | 73-79 | 135-155 | 77-83 | 175-195 | 78-84 | 201-221 | 85-91 | 309-329 |
| **015** | 75 | 69-75 | 130-150 | 75-81 | 172-192 | 77-83 | 222-242 | 80-86 | 272-292 |
| | 80 | 72-78 | 140-160 | 78-84 | 182-202 | 80-86 | 232-252 | 83-89 | 282-302 |
| | 85 | 75-81 | 150-170 | 81-87 | 192-212 | 83-89 | 242-262 | 86-92 | 292-312 |
| **019** | 75 | 69-75 | 130-150 | 73-79 | 174-194 | 77-83 | 210-230 | 81-87 | 280-300 |
| | 80 | 72-78 | 140-160 | 76-82 | 184-204 | 80-86 | 220-240 | 85-91 | 290-310 |
| | 85 | 75-81 | 150-170 | 79-85 | 192-212 | 83-89 | 230-250 | 89-95 | 300-320 |
| **024** | 75 | 69-75 | 130-150 | 73-79 | 174-194 | 77-83 | 210-230 | 87-93 | 307-327 |
| | 80 | 72-78 | 140-160 | 76-82 | 184-204 | 80-86 | 220-240 | 90-96 | 317-337 |
| | 85 | 75-81 | 150-170 | 79-85 | 192-214 | 83-89 | 230-250 | 93-99 | 327-347 |
| **030** | 75 | 66-72 | 140-160 | 74-80 | 186-206 | 76-82 | 210-230 | 86-92 | 307-327 |
| | 80 | 69-75 | 150-170 | 77-83 | 196-216 | 79-85 | 220-240 | 89-95 | 317-337 |
| | 85 | 72-78 | 160-180 | 80-86 | 206-226 | 82-88 | 230-250 | 92-98 | 327-347 |
| **036** | 75 | 66-72 | 128-148 | 71-77 | 160-180 | 72-78 | 210-230 | 82-88 | 307-327 |
| | 80 | 69-75 | 138-158 | 74-80 | 170-190 | 75-81 | 220-240 | 85-91 | 317-337 |
| | 85 | 72-78 | 148-168 | 77-83 | 180-200 | 78-84 | 230-250 | 88-94 | 327-347 |
| **042** | 75 | 70-76 | 119-139 | 73-79 | 166-186 | 75-81 | 205-225 | 80-86 | 299-319 |
| | 80 | 73-79 | 129-149 | 76-82 | 176-196 | 78-84 | 215-235 | 83-89 | 309-329 |
| | 85 | 76-82 | 139-159 | 79-85 | 186-206 | 81-87 | 225-245 | 86-92 | 319-339 |
| **048** | 75 | 61-67 | 123-143 | 65-71 | 169-189 | 66-72 | 194-214 | 70-76 | 286-306 |
| | 80 | 64-70 | 133-153 | 68-74 | 179-199 | 69-75 | 204-224 | 73-79 | 296-316 |
| | 85 | 67-73 | 143-163 | 71-77 | 189-209 | 72-78 | 214-234 | 76-82 | 306-326 |
| **060** | 75 | 62-68 | 146-166 | 67-73 | 199-219 | 70-76 | 208-228 | 82-88 | 304-324 |
| | 80 | 65-71 | 156-176 | 70-76 | 209-229 | 73-79 | 218-238 | 85-91 | 314-334 |
| | 85 | 68-74 | 166-186 | 73-79 | 219-239 | 76-82 | 228-248 | 88-94 | 324-344 |

### NORMAL OPERATING PRESSURES

Normal operating pressures are the pressures that the unit should be operating at when the water flow is adjusted to 3 gpm/ton. Under these conditions, the difference between entering and leaving water temperatures is about 10°F in cooling mode and 6°F in heating mode. The difference between entering and leaving air temperature is about 20°F in cooling mode and 27°F in heating mode. Normal operating pressure is based on 80 db/67 wb return air in cooling mode and 70 db return air in heating mode. See Tables 6 and 7 for operating pressures.

### DESUPERHEATERS/HOT WATER GENERATORS

The 50YAV,YAH offers a factory installed, optional hot water generator. This option utilizes heat from "superheated" refrigerant to produce hot water.

Fig. 9 is a typical example of hot water generator water piping connections on a 50YAV with a factory-installed pump.

Fig. 10 is a typical example of hot water generator water piping connections on a 50YAH with the field-installed pump. Using a concentric hot water tank connection fitting eliminates the need to tie into the hot water tank cold water piping.

If a concentric fitting is not used, an arrangement suitable for either circulating pump configuration is shown in Fig. 11.

The installation method illustrated in Fig. 11 is very useful if scaling or mineral residue normally creates a problem in hot water tanks in your area. The water flow path illustrated continually cleans the seat of the check valve, "shocks" the heat exchanger to prevent scale build-up, and purges and reprimes the circulator pump.

Water flow discharges to the bottom of the hot water tank so residue at the bottom of the tank is not sucked into the pump and heat exchanger. This circulates the tank to heat the entire tank. Regardless of the connection methods used, if scaling or residue problems exist you should add provisions for periodic maintenance. Under extreme conditions, it may be wise to not use the hot water generator option since the probable cost of frequent maintenance may offset or exceed any savings.

### INSTALLATION OF HOT WATER GENERATOR

The field-installed circulating pump should be connected to the "Water In" port on the heat pump. DO NOT CONNECT POWER TO THE PUMP UNTIL THERE IS WATER IN THE HOT WATER TANK. Locate the hot water tank as close to the heat pump as possible.

The hot water generator aquastat is set at 125°F and is located on the hot water generator heat exchanger "Water In" line. If the water generator is connected incorrectly or if circulation is reversed, the aquastat will sense leaving water temperature and prevent hot water generator operation.

**⚠ WARNING**

UNDER NO CIRCUMSTANCES DISCONNECT OR REMOVE THE HOT WATER GENERATOR AQUASTAT. Full load conditions could drive hot water tank temperatures far above desirable levels if the aquastat has been disconnected or removed.

The heat pump, water piping, pump, and hot water tank should be located where the ambient temperature does not fall below 50°F. Keep water piping lengths at a minimum. DO NOT use a 1 way length greater than 50 ft. All installations must be made in accordance with local codes. The installer is responsible for knowing the local requirements, and for performing the installation accordingly.

## Table 5—Heating Operating Pressures

| UNIT SIZE | ENT. AIR TEMP | ENT. FLUID TEMP. | SUCT | DISCH | UNIT SIZE | ENT. AIR TEMP. | ENT. FLUID TEMP. | SUCT | DISCH |
|---|---|---|---|---|---|---|---|---|---|
| | | 25 | 37-43 | 157-177 | | | 25 | 31-37 | 157-177 |
| | | 30 | 42-48 | 165-185 | | | 30 | 37-43 | 167-187 |
| | | 40 | 50-56 | 170-190 | | | 40 | 47-53 | 184-204 |
| **009** | 70 | 50 | 61-67 | 181-201 | **030** | 70 | 50 | 56-62 | 207-227 |
| | | 60 | 68-74 | 186-206 | | | 60 | 67-73 | 220-240 |
| | | 70 | 76-82 | 190-210 | | | 70 | 77-83 | 242-262 |
| | | 80 | 77-83 | 200-220 | | | 80 | 87-93 | 257-277 |
| | | 25 | 36-43 | 166-186 | | | 25 | 38-44 | 169-189 |
| | | 30 | 40-46 | 180-200 | | | 30 | 39-45 | 180-200 |
| | | 40 | 51-57 | 188-208 | | | 40 | 48-54 | 182-202 |
| **012** | 70 | 50 | 60-66 | 208-228 | **036** | 70 | 50 | 58-64 | 197-217 |
| | | 60 | 71-77 | 217-237 | | | 60 | 68-74 | 208-228 |
| | | 70 | 81-87 | 237-257 | | | 70 | 81-87 | 226-246 |
| | | 80 | 85-91 | 240-260 | | | 80 | 89-95 | 240-260 |
| | | 25 | 32-38 | 160-180 | | | 25 | 34-40 | 156-176 |
| | | 30 | 37-43 | 165-185 | | | 30 | 41-47 | 166-186 |
| | | 40 | 46-52 | 176-196 | | | 40 | 48-54 | 171-191 |
| **015** | 70 | 50 | 56-62 | 187-207 | **042** | 70 | 50 | 58-64 | 187-207 |
| | | 60 | 65-71 | 197-217 | | | 60 | 68-74 | 197-217 |
| | | 70 | 75-81 | 207-227 | | | 70 | 80-86 | 212-232 |
| | | 80 | 87-93 | 219-239 | | | 80 | 87-93 | 223-243 |
| | | 25 | 31-37 | 169-189 | | | 25 | 37-43 | 174-194 |
| | | 30 | 36-42 | 174-194 | | | 30 | 42-48 | 181-201 |
| | | 40 | 47-53 | 185-205 | | | 40 | 47-53 | 186-206 |
| **019** | 70 | 50 | 57-63 | 196-216 | **048** | 70 | 50 | 52-58 | 203-223 |
| | | 60 | 65-71 | 205-225 | | | 60 | 60-66 | 216-236 |
| | | 70 | 76-82 | 219-239 | | | 70 | 67-73 | 228-248 |
| | | 80 | 88-94 | 228-248 | | | 80 | 72-78 | 245-265 |
| | | 25 | 33-39 | 160-180 | | | 25 | 30-36 | 169-189 |
| | | 30 | 38-44 | 165-185 | | | 30 | 36-42 | 183-203 |
| | | 40 | 46-52 | 172-192 | | | 40 | 44-50 | 199-219 |
| **024** | 70 | 50 | 56-62 | 181-201 | **060** | 70 | 50 | 54-60 | 220-240 |
| | | 60 | 62-68 | 188-208 | | | 60 | 63-69 | 239-259 |
| | | 70 | 70-76 | 197-217 | | | 70 | 75-81 | 261-281 |
| | | 80 | 78-84 | 206-226 | | | 80 | 83-89 | 279-299 |

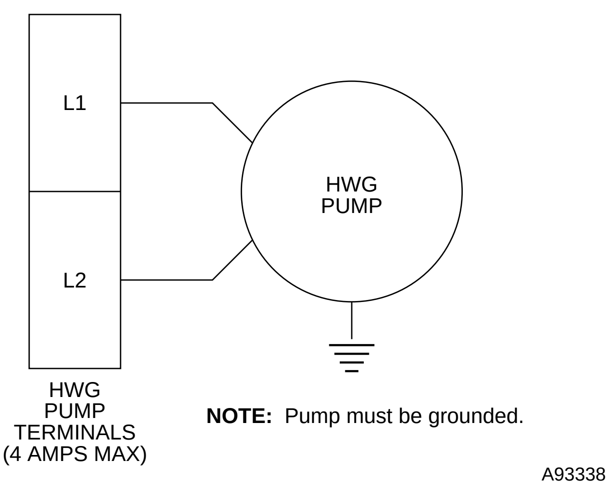



**Fig. 11—Circulating Pump Configuration**

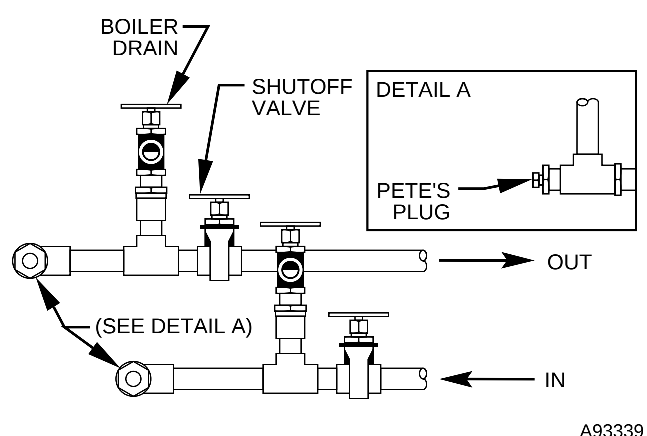



**Fig. 12—Shut Off Valve**

7. Install hot water generator water piping.

WATER TANK PREPARATION

1. Turn off power or fuel supply to the hot water tank.
2. Connect a hose to the drain valve on the water tank.
3. Shut off the cold water supply to the water tank.
4. Open the drain valve and open the pressure relief valve or a hot water faucet.
5. In an existing tank, once drained, the tank should be flushed with cold water until the water leaving the drain hose is clear and free of sediment.
6. Close all valves and remove the drain hose.

HOT WATER GENERATOR WATER PIPING

1. If necessary, install the circulating pump.

CAUTION - THE PUMP SHAFT MUST BE HORIZONTAL

2. Using at least 5/8 in. O.D. copper tubing, route and install the water piping, valves, and air vent as shown in Fig. 9-12. When used, the air vent MUST be at the high point of the hot water generator water piping.
3. Insulate all hot water generator water piping with no less than 3/8 in. wall closed cell installation.
4. Open both shut-off valves and make sure the tank drain valve is closed.

WATER TANK REFILL

1. Open the cold water supply to the tank.
2. Open a hot water faucet to vent air from the system until water flows from the faucet, then close.
3. Depress the hot water tank pressure relief valve handle to ensure there is no air remaining in the tank.
4. Slowly unscrew the shaft plug from the pump motor until all air is purged from the pump, then replace.
5. Inspect all work for leaks.
6. Before restoring the power or fuel supply to the water heater, adjust the temperature setting on the tank thermostat(s) to ensure maximum utilization of the heat available from the refrigeration system and to conserve the most energy. On tanks with both upper and lower elements and thermostats, the lower element should be turned down to 100°F, while the upper element should be adjusted to 120°F. On tanks with a single thermostat, lower the thermostat setting to 120°F or the "low" position.
7. Replace access cover(s) and restore power or fuel supply.

INITIAL START-UP

1. Make sure all valves in the hot water generator water circuit are full open.
2. Turn on the heat pump and allow it to run for 10-15 minutes.
3. Turn the heat pump and heat pump power supply "off" and connect power to the remote hot water generator pump as shown in Fig. 10. On units with an internally mounted pump, connect the pump power lead as instructed on the lead tag.
4. The hot water generator pump should not run if the compressor is not running.
5. The temperature difference between the water entering and leaving the hot water generator coil should be about 10°F.
6. Allow the unit to operate for 20 to 30 minutes to ensure it is functioning properly.
7. When the pump is first started, the shaft may rotate slowly until the water has penetrated the bearings. If the pump does not run, the shaft can be turned manually. To accomplish this, turn off the electrical supply. Close the shut-off valves on each water line. Remove the shaft plug in the middle of the nameplate with a slot type screwdriver. Insert a small slot type screwdriver into the end of the shaft and gently turn until the shaft moves freely. Replace and tighten the plug. Open the valves and wait 2 to 3 minutes for the system pressure to equalize before starting the pump.

## MAINTENANCE

Perform the maintenance procedures outlined below at the intervals indicated.

**⚠ WARNING**

Before servicing unit, open unit disconnect switch to prevent injury or death due to electrical shock or contact with moving parts.

FILTERS

Inspect filters every month. Replace as needed.

**⚠ CAUTION**

To avoid fouled machinery and extensive unit clean-up, do not operate units without filters in place or use as a temporary heat source during construction.

To remove the filter, simply slide the filter out of its frame. When installing a new filter, be sure to use the slide-in rails to guide the filter into the proper position. Verify that the airflow arrow found on the top of each filter points toward the unit.

CONDENSATE DRAINS

Check condensate drain pans for algae growth at 3 month intervals.

When algae growth is apparent, consult a water treatment specialist for proper chemical treatment.

VISUAL INSPECTION

Visually inspect the unit at least once each year.

When inspecting each horizontal and vertical unit, give special attention to the hose assemblies; note any signs of deterioration or cracking, and repair any leaks immediately.

REFRIGERANT COIL

Inspect the refrigerant coil at least once each year (or more frequently if the unit is located in a "dirty" environment). Clean as required.

CONDENSATE DRAIN LINE

If the unit is installed above a ceiling, it must have an additional drain pan under the entire length of the unit. You should never see water coming from the auxiliary drain line connected to this pan, as it is used to collect emergency water.

WATER COIL

The water coil requires very little maintenance. Scale is the primary concern. Closed loop applications will not normally see any scale build-up because the liquid in the water side plumbing is not usually changed once the system is checked and started up.

Open systems, such as wells and surface water sources, can accumulate this coil scale if the installation is done incorrectly. Suction line leaks on above-ground water pumps and low water flows in the cooling mode will cause scaling. Low water flow in cooling mode will cause the temperature rise across the water coil to increase. Temperature change will cause the impurities in the water to precipitate out and become deposited on the walls of the heat exchanger.

If a cleaning solution is used to clean the heat exchanger, a sample of the scale should be checked to ensure that it will dissolve. Any cleaning agent must also be checked to ensure that it will not attack copper, nickel, or copper-nickel alloys.

## TROBLESHOOTING

### Thermostat In On Position, But Unit Does Not Operate

| SYMPTOM | SECONDARY SYMPTOM | CHECKS AND CORRECTIONS |
|---|---|---|
| **Contactor Closed** | Compressor Silent | Check for faulty or incorrect wiring in the line voltage circuit, overheated contacts, open compressor windings, or overloaded. |
| | Compressor HUMS then Opens on Internal Overload | Check for low line voltage, loose connections, defective start relay, or compressor capacitor. Check to see if the compressor has open or grounded windings. If the unit is new, try a hard start kit. Also, check the refrigerant circuit for unequalized pressures or contaminates. |
| **Contactor Open** | Contactor Buzzing | Check the control voltage—it should be between 20 and 27 v. If there is normal voltage to the coil, the contactor could be defective or fouled. If less than 20 v the coil, check the line voltage and the transformer line tap. The low voltage transformer or thermostat could be defective, or the thermostat wiring could be undersized or too long. |
| | Contactor Silent | The contactor coil could be defective. If there is no voltage to the coil, the problem could be a loose wire, inoperative thermostat, or the safety circuit. If the safety circuit is the problem, the high-pressure switch could have tripped due to high pressure, the freezestat could have tripped due to low water temperature, the low pressure sensor could have tripped due to low pressure or any of the above may be defective. If the unit was off on a safety switch and the problem has been corrected, be sure to interrupt power to reset the lockout relay. |

### Unit Starts And Shuts Off

| SYMPTOM | SECONDARY SYMPTOM | CHECKS AND CORRECTIONS |
|---|---|---|
| **Lockout Relay Not Energized** | Compressor Shuts Off | High amp draw or high discharge pressure could cause the compressor overload to trip. Electrical problems could be low voltage, faulty wiring, or overheated contacts. |
| **Lockout Relay Energized** | High-Pressure Switch Opens | High pressure could be caused in the cooling mode by low water flow. On open loop systems this can be caused by loss of water flow, restricted heat exchanger, incorrect pump sizing, incorrect water-flow or a dirty water filter or strainer. On closed loop systems the causes can be water systems air lock, restricted heat exchanger, incorrect pump sizing, incorrect water flow, a fouled pump impeller, or loss of water flow.<br><br>High pressure could be caused in the heating mode by low air flow. The fan motor could have incorrect voltage, be incorrectly wired, be on the wrong speed, be rotating the wrong direction, be overloaded, be defective, or have a defective capacitor. The fan could be loose on the shaft or icorrectly located in the housing. There could be problems in the air stream such as restricted air path, dirty filter or air coil, or incorrectly designed or installed duct system.<br><br>Other possible problems could be incorrect or contaminated refrigerant charge, restricted or poorly operating expansion device, high suction pressure, or high entering air temperature. |
| | Low-Pressure Sensor Opens | In the cooling mode, low pressure could be caused by low air flow. A frosting air coil or low entering air temperature are possible causes. Other possible cause are listed under LOCKOUT RELAY ENERGIZED—HIGH- PRESSURE SWITCH in this section.<br><br>Low pressure could be caused by incorrect refrigerant charge, restricted or faulty expansion device, or a restriction in the distributor, liquid line, or suction line.<br><br>In the heating mode, low pressure could be caused by low water flow or low entering water temperature. Causes for low water are listed under LOCKOUT RELAY ENERGIZED—HIGH-PRESSURE SWITCH in this section.<br><br>Low water temperatures can be caused by exposing water piping to ambient conditions or an improperly designed or installed ground loop. |
| | Freezestat Opens | Low entering water temperature or low water flow can cause the freezestat to trip. Causes for low water flow are listed under LOCKOUT RELAY ENERGIZED—HIGH PRESSURE SWITCH in this section<br><br>Causes for low water temperatures are listed under LOCKOUT RELAY ENERGIZED—LOW PRESSURE SENSOR in this section. |

## Unit Short Cycles

| SYMPTOM | SECONDARY SYMPTOM | CHECKS AND CORRECTIONS |
|---|---|---|
| **Unit Oversized** | Incorrect Load Calculation | Recalculate the building load. To assure satisfactory conditions within the building, it may be necessary to install a smaller unit. |
| **Contactor Closed** | Run Capacitor Defective | Replace the capacitor. |
| | Compressor Overloaded | If amp draw is normal, compressor windings are overheated or the overload is defective. If amp draw is high, the compressor may be operating against high head pressure, the motor may be defective, or the compressor may be tight. Voltage may be low or the power wiring could be faulty. |
| **Contactor Opens and Closes** | Thermostat Problem | The thermostat can be incorrectly installed; that is, not level or located in areas where it is affected by a source other than the conditioned space ambient air. Also check for incorrect heat anticipator setting or defective thermostat. |

## Inadequate Cooling

| SYMPTOM | SECONDARY SYMPTOM | CHECKS AND CORRECTIONS |
|---|---|---|
| **High Suction/Low Discharge** | Compressor | Check for leaking compressor. |
| **High Suction/High Discharge** | | This can be caused by an excessive load, the strains of initial cool down. Also check for incorrect refrigernat charge or reversing valve operation. |
| **Low Suction Pressure** | Low Air Flow | As discussed in the UNIT STARTS AND SHUTS OFF portion of this section, air flow problems can be caused by fan, filter, or the air stream. |
| | Low Refrigerant Flow | Low refrigerant flow can be caused by loss of refrigerant, a restriction in the refrigerant circuit, or a faulty expansion device. |
| **High Discharge** | Low Water Flow | As mentioned in the UNIT STARTS AND SHUTS OFF portion of this section, water flow problems can be caused by incorrect flow or pump sizing, heat exchanger fouling, air locking or clogged-/fouled water filter, or pump impeller. |
| | High Suction Pressure | High suction pressure can be caused by incorrect refrigerant charge, faulty expansion device, or low water flow. |
| **Other Causes** | Low Amp Draw | Check for leaking compressor valves. |
| | Evaporating Icing | Evaporating icing can be caused by room air or entering water temperatures being too cold or low air flow. |

## Inadequate Heating

| SYMPTOM | SECONDARY SYMPTOM | CHECKS AND CORRECTIONS |
|---|---|---|
| **High Suction/Low Discharge** | Compressor | Check for leaking compressor. |
| **High Suction/High Discharge** | | This can be caused by an excessive load, the strains of initial warm up, or high entering water temperature. Also check for a reversing valve problem. Check for correct refrigerant charge as a last resort. |
| **Low Suction** | Low Water Flow | As mentioned in the UNIT STARTS AND SHUTS OFF portion of this section, water flow problems can be caused by incorrect flow or pump sizing, heat exchanger fouling, air locking, clogged/fouled water filter, or pump impeller. |
| | Low Refrigerant Flow | Low refrigerant flow can be caused by loss of refrigerant, a restriction in the refrigerant circuit, or a faulty expansion device. |
| **High Discharge** | Low Air Flow | As discussed in the UNIT STARTS AND SHUTS OFF portion of this section, air flow problems can be caused by fan, air filter, or the air stream. |
| **Unit Off on Freezestat** | Open Loop Systems | On open loop systems the freezestat will shut the unit down due to water supply problemsor low entering water temperature. |
| | Closed Loop Systems | On closed loop systems the freezestat will shut down the unit due to water loop problems or not installing a low temperature freezestat when ANTIFREEZE is used. If the ground loop is properly sized and installed, the low temperature freezestat should never trip. |
| **Other Causes** | High Amp Draw | A tight compressor or low supply voltage can cause high amp draw. |

## Other

| SYMPTOM | SECONDARY SYMPTOM | CHECKS AND CORRECTIONS |
|---|---|---|
| **Water Drips From Unit** | Condensate Drain | Check to see that the unit is pitched to allow for proper drainage and that the condensate piping is not restricted. Check for more than 1 trap in the condensate drain line. |
| **Compressor Will Not Shut Off** | | Check for stuck or frozen contacts. |
| **Noisy Operation** | Compressor | Check to see if all shipping blocks were removed and that the mounting bolts have been loosened so that the compressor floats freely. See if there is any metal to metal contact as a result of shipping damage. |
| | Blower Assembly | Check the blower assembly for clearance and alignment and to see if the blower wheel is loose on the shaft. Check the motor for bad bearings. |
| | Contacts Chatter | Check for long low-voltage wiring runs and control power less than 20v at the contactor. |
| | Water Noise | Check for excessive water flow or air in the water. |
| | Air Noise | Check for undersized or improperly balanced ductwork. If CFM is too high, reduce blower speed. |
| **Low Water Temperature Differential** | Open Loop | Check for heat exchanger fouling or excessive water flow. |
| | Closed Loop | Check for inadequate antifreeze in loop or ice forming in the heat exchanger. |

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